

HOPEWELL FURNACE NATIONAL HISTORIC SITE
FISHERIES SURVEY

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INTRODUCTION

Nestled in a valley in southeastern Pennsylvania, near the headwaters of French Creek, rests Hopewell Furnace. The pastoral environment of the reconstructed iron furnace belies its past, as Hopewell was, from its construction in 1771 to its demise in 1883, a highly productive source of cast-iron goods and unrefined “pig” iron. Located at the border of Berks and Chester Counties, about 50 miles northwest of Philadelphia, Hopewell lies in the heart of a region that is steeped in early American history.

The U.S. Government acquired the land surrounding Hopewell Furnace in 1935, and a historic site was created there on August 3, 1938 (Figure 1). The locale was selected for restoration and preservation because it serves as an excellent representative of “iron plantations” which dotted the Pennsylvanian landscape during the eighteenth and nineteenth centuries. Regional availability of resources was a crucial consideration when choosing furnace locations during that era. Important resources included extensive stands of hardwoods for charcoal production, mineable outcrops of iron-rich rock, and substantial flowing water in the furnace’s vicinity. Water was diverted from a stream channel or lake to the furnace’s waterwheel, which powered “blast machinery” that fanned the flames within the furnace.

Supplies of water were not always adequate at Hopewell. Two headraces were used to divert water from three streams on the plantation grounds. The East Headrace captured water from Spout Run and Baptism Creek, and the West Headrace drained water from the furnace pond, now overlain by Hopewell Lake. Water supplies were also utilized for domestic needs, livestock consumption, irrigation, and refrigeration, since the

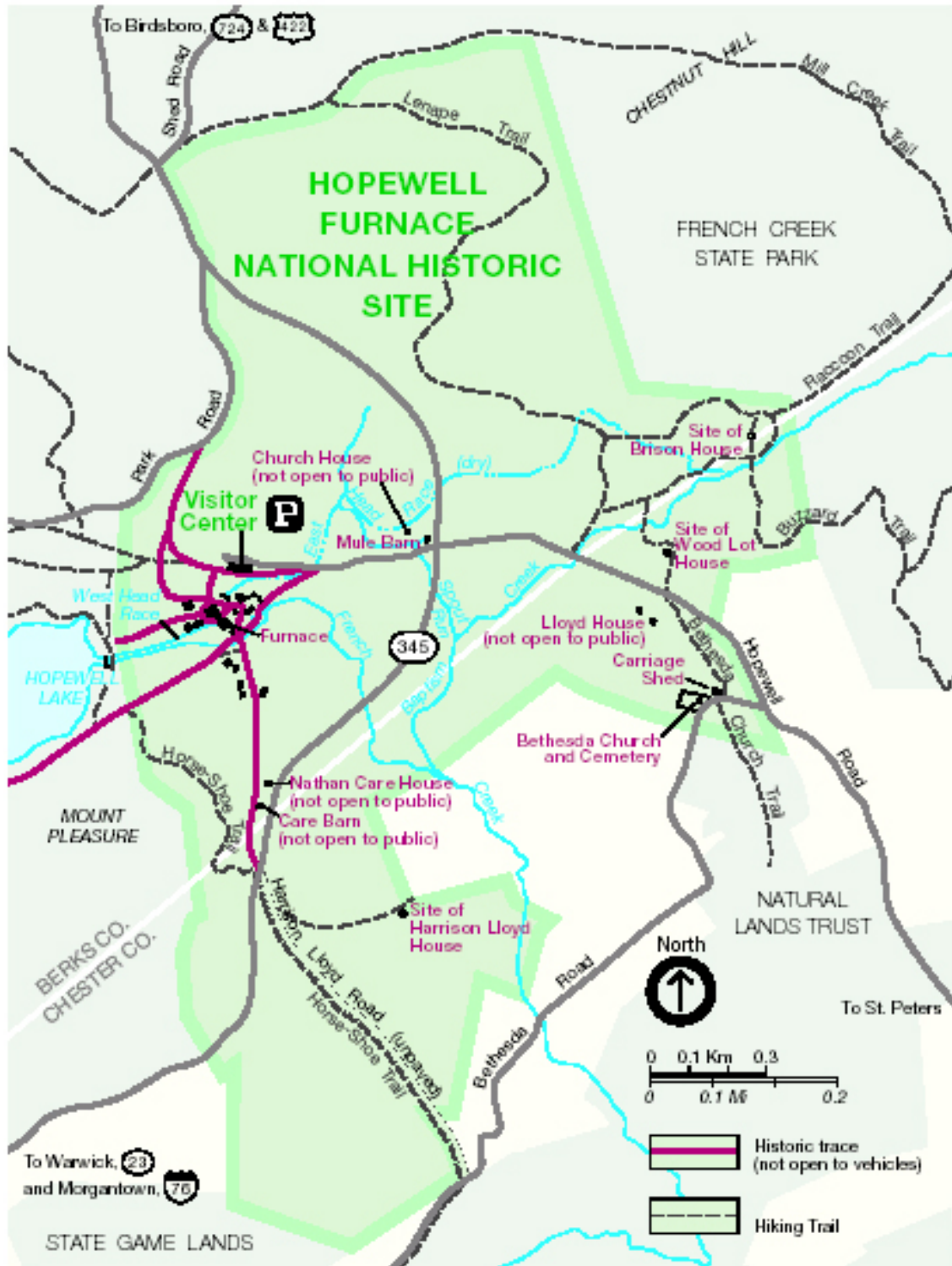


Figure 1. Hopewell Furnace National Historic Site (General Map)

plantation was inhabited by a population of iron workers and their families. Perennial springs located on a hillside near the furnace likely furnished cool drinking water.

Production at Hopewell Furnace was also facilitated by the presence of raw materials. Extensive shallow deposits of magnetite-rich rock were located nearby, providing easily accessed iron ore for the smelting process. The forestland in the area held large stands of American chestnut and black oak trees used in the production of charcoal. A constant quantity of charcoal was required to maintain sufficiently high furnace temperatures. Today, the Hopewell ironworks and associated infrastructure have been restored. This report presents a survey of fish communities in the three streams located in the park.

Land Use and Planning Relationships

Hopewell Furnace National Historic Site (NHS) has an area of 343 ha (848 acres), with no inholdings (Figure 1). It is divided between two townships, Union and Warwick, which lie within Berks and Chester Counties, Pennsylvania, respectively. Approximately two-thirds of Hopewell Furnace NHS is bordered by French Creek State Park, a park of primarily recreational value, which receives substantial summer tourism. The remaining one-third is bordered by agricultural lands and low density residential development.

The privately owned lands adjacent to Hopewell Furnace NHS are situated to the south entirely within Warwick Township. In the late 70's, Warwick residents assumed an anticipatory stance regarding developmental pressures creeping into the township along its major byways. Consultation with a land use planning specialist resulted in a set of long-range goals for growth control in the township. These goals include preservation of historic character, conservation of agricultural lands, protection of environmentally

sensitive areas, and provision of orderly development. Although the lands south of Hopewell Furnace NHS are still at risk of piecemeal, high-density development, citizen activism has reduced the risk to a minimum.

French Creek State Park contains nearly all the French Creek Basin upstream of Hopewell Furnace NHS, and therefore is the source of much of the streamwater found in French Creek within National Park Service (NPS) boundaries. Because of this relationship, the land use activities in the state park warrant as much attention as those occurring in Hopewell Furnace NHS itself. Because Hopewell Lake, the source of French Creek, is located in French Creek State Park, all activities that affect Hopewell Lake water quality or quantity also impact French Creek. These conditions emphasize the need for cooperative management of water resources by Hopewell Furnace NHS and French Creek State Park in the uppermost portion of the French Creek Basin.

At present, the most potentially significant land use activity at French Creek State Park is the periodic operation of a spray field for land application of state park sewage. The spray field is situated at or near the summit of Mt. Pleasure, which is located on the hydrologic boundary separating the French Creek and Pine Creek watersheds. Most of the sprayed water evaporates or infiltrates into the underlying soil and bedrock on Mt. Pleasure; consequently, contamination of French Creek is not a concern at the present level of spray field operation.

Management of Hopewell Furnace NHS is determined by designated uses that are:

- 1) Eastern deciduous forest-257 ha (635 acres) of the park area. Conservation of woodlands, recreation and scientific study.
- 2) Agricultural uses in twelve fields-54 ha (135 acres) of the park area.
- 3) Historic and developed areas-32 ha (78 acres) of the park area.

THE HYDROLOGIC ENVIRONMENT

Physiographic Description

The headwaters of the French Creek watershed flow from springs in the Piedmont hills of southeastern Pennsylvania. Prominent topographic highs in the Hopewell Furnace NHS vicinity include Williams Hill, Brush Hill, Chestnut Hill, and Mt. Pleasure. These hills rise approximately 250-300 meters (800-1000 feet) above mean sea level, and 120 meters (400 feet) above French Creek as it flows through the core historic district (Figure 2).

Aquatic Biota

French Creek supports a diverse aquatic ecosystem, indicating relatively high water quality. Scotts Run Lake, which connects to Hopewell Lake and eventually drains into French Creek, is stocked with rainbow and brown trout (*Oncorhynchus mykiss* and *Salmo trutta*) by the Pennsylvania Fish and Boat Commission. Two other creeks at HOFU were stocked with brook trout: Baptism Creek, once a year from 1949-1951 and Spout Creek, once a year from 1950-1951. Both streams empty into French Creek.

Many other varieties of fish have been recorded in the waters of French Creek. These include minnows (*Pimphales notatus/promelas*), daces (*Rhinichthys atratulus/cataractae*), pickerels (*Esox a. americanus/niger*), sunfishes (*Lepomis auritus/cyanellus/gibbosus*), shiners (*Notropis hudsonius/procne/spilopterus*), darters (*Etheostoma olmstedii*), killifish (*Fundulus diaphanus*), and madtoms (*Noturus insignis*). Creek chub (*Semotilus atromaculatus*), white suckers (*Catostomus commersoni*), and fallfish (*Semotilus corporalis*) also live in Hopewell Furnace NHS stream water, as well as rock bass (*Ambloplites rupestris*) smallmouth (*Micropterus dolomieu*), and

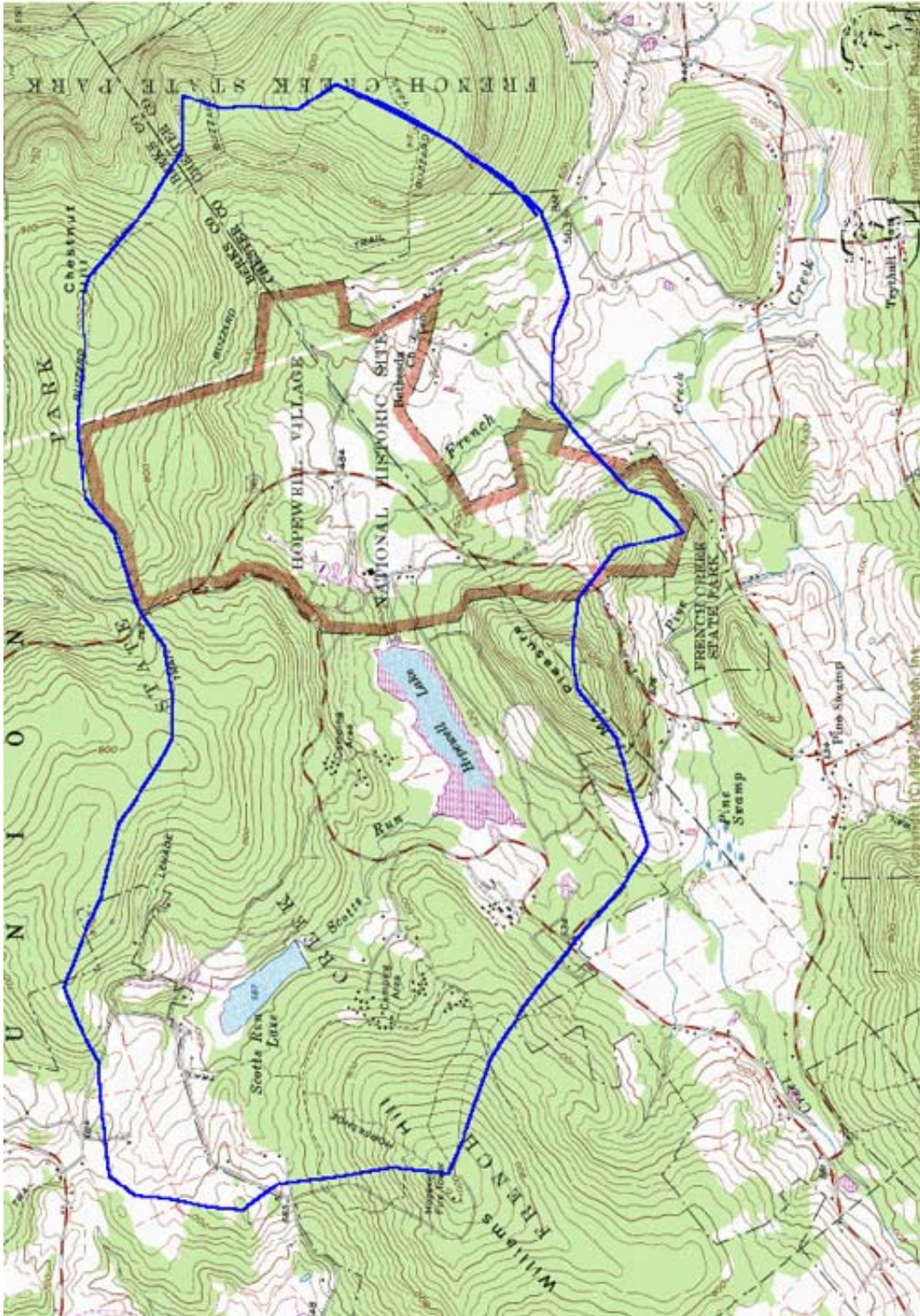


Figure 2. Hydrologic boundary for the Upper French Creek Watershed (outlined in blue)

largemouth bass (*Micropterus salmoides*). In 1990, 1991, and 1992, electrofishing surveys were undertaken to determine species and numbers of fish in French Creek at Hopewell Furnace NHS (Gutowski, 1996). The results of these surveys are presented in Appendix C. No threatened or endangered fish species are known to exist in Hopewell Furnace NHS.

CURRENT FISH ASSESSMENT

Methods

An inventory of fish species present within the Hopewell Furnace NHS was conducted. The purpose of this inventory was to record all species of fish present within the historic site along with their relative abundance.

Three fish survey sites were selected that included French Creek at the Route 345 bridge, Spout Run, and Baptism Creek. Survey sites are represented in Figure 3 as follows: 1 (Spout Run); 2 (Baptism Creek); 3 (French Creek). A 90-meter section of stream was surveyed at each site. Fish were temporarily immobilized with a battery powered backpack electro-shocker (Smith-Root) and held in nets and buckets for sorting and counting. Voucher specimens were retained for positive identification and permanently archived in The Pennsylvania State University fish collection. All remaining fish were returned to the stream from which they were collected. Collection sites were located by GPS. The GPS locations coincide with the most downstream point in each 90 meter survey section (the fish survey starting point). All surveys were completed on August 21, 2002.

At the request of the Project Officer, a habitat assessment was added to the methods subsequent to the fish survey. EPA's Rapid Bioassessment Protocol (EPA 1997) was used. In addition, at the request of the Project Officer, widths of the surveyed sections and their riffle/pool ratios were measured, substrate types were recorded, section widths noted and water temperatures were recorded.

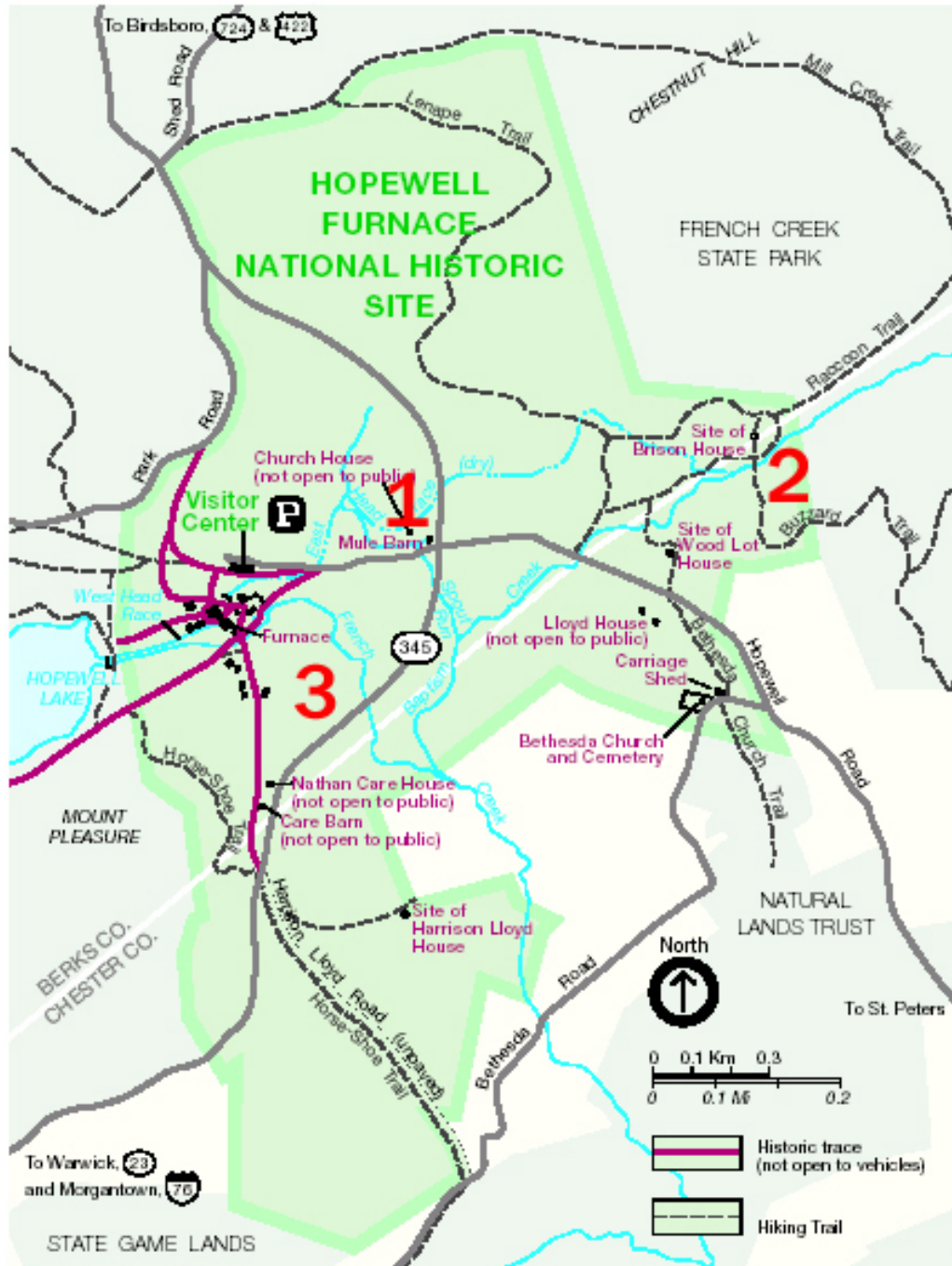


Figure 3. Sampling sites for Hopewell Furnace NHS Fish Survey (1. Spout Run, 2. Baptism Creek, and 3. French Creek)

RESULTS AND DISCUSSION

The rapid bioassessment results and other fish habitat characteristics are reported in Appendix A. The maximum possible rapid bioassessment score is 200, which is indicative of the most undisturbed habitat in the best condition. The scores were relatively good for all 90 meter sections surveyed with Baptism Creek scoring 177, Spout Creek 143 and French Creek 122. Water temperatures were obtained at the beginning of each survey section and are indicative of cold water species (*Salvelinus fontinalis*) in Spout Run and Baptism Creek and warm water fishes in French Creek.

The fish species identified and the number present in each 90 meter survey section are given in Appendix B. French Creek contained the largest number of species all of which would be classified as warm water species. The relatively small size of Spout Run was evidenced by the reduced number of species present.

A comparison of number and fish species identified is included in Appendix C. No species were present in 2002 that were not previously recorded; however, four species were present in previous surveys, but not in 2002. These species were *Clinostomus funduloides*, *Luxilus cornutus*, *Esox a. americanus* and *Lepomis gibbosus*. Only small numbers of these species occurred in previous surveys; consequently, it is difficult to assign great significance to their absence in the 2002 survey.

There is little noteworthy in the water quality data for samples taken at the time of the fish survey. These data are presented in Appendix D. Baptism Creek pH and specific conductance were noticeably lower than Spout Run and French Creek probably indicating that Baptism Creek water was in contact with bedrock that is more resistant to weathering.

SUMMARY AND CONCLUSIONS

Fish surveys reported the presence of brook trout (*Salvelinus fontinalis*) in Spout Run and Baptism Creek and similar warm water species in French Creek to those identified in previous surveys. This survey recorded four fewer species in French Creek than previous surveys, but the number of individuals of these species was small; consequently, no special significance can be attached to their lack of presence.

REFERENCES

- Pennsylvania Department of Environmental Resources. 1978. Characteristics of Pennsylvania Recreational Lakes. Bull. No. 14. Harrisburg, PA. 226 p.
- Pennsylvania Department of Environmental Resources. 1984. Gazetteer of Streams. Part II., Bull. No. 16. Harrisburg, PA 418 p.
- Pennsylvania Fish and Boat Commission. 1977. Stream Examination Reports for French, Baptism and Spout Creeks.
- Sharpe, W.E. and C.W. Neff. 1993. Hopewell Furnace National Historic Site Water Resource Management Plan: Final Report. Environmental Resources Research Institute, University Park, PA.
- Gutowski, M. 1996. Prediction of Resistance and Resilience of Stream Ecosystems. Draft Report to the National Park Service. The Pennsylvania State University, University Park, PA. 26 p.

APPENDICES

**Appendix A. Stream Assessment Data for the 90 Meter Fish Survey
Sections, Hopewell Furnace NHS, Augusts 21, 2002**

	Spout Run	Baptism Creek	French Creek
Location (Latitude, Longitude)	N 40.20747, W 75.76917	N 40.20760, W 75.76026	N 40.20483, W 75.76919
Temperature (degrees C)	19.3	21.1	27.6
Substrate Type	Cobble	Cobble	Silt/Pebble
RBP Habitat Assessment Score	143	177	122
Riffle/Pool Ratio	11:09	1:01	1:02

Appendix B. Number of Fish by Species in the 90 Meter Fish Survey Sections, Hopewell Furnace NHS, August 21, 2002.

Common Name	Scientific Name	Spout Run	Baptism Creek	French Creek
American eel	<i>Anguilla rostrata</i>			1
White sucker	<i>Catostomus commersoni</i>			12
Rosyside dace	<i>Clinostomus funduloides</i>		42	
Chain pickerel	<i>Esox niger</i>			3
Tessellated darter	<i>Etheostoma olmstedii</i>			8
Cutlips minnow	<i>Exoglossum maxilllingua</i>			10
Yellow gullhead	<i>Ictalurus natalis</i>			8
Bluegill	<i>Lepomis macrochirus</i>			6
Largemouth bass	<i>Micropterus salmoides</i>			1
Margined madtom	<i>Noturus insignis</i>			10
Blacknose dace	<i>Rhinichthys atratulus</i>	105	104	26
Blacknose dace	<i>R. atratulus</i> YOY ¹	17	10	
Brook trout	<i>Salvelinus fontinalis</i>	2	5	
Creek chub	<i>Semotilus atromaculatus</i>		74	11
Creek chub	<i>S. atromaculatus</i> YOY		5	
Fallfish	<i>Semotilus corporalis</i>			62
	Total	124	240	158

¹YOY is an abbreviation for young of year.

Appendix C. Comparison of fish species found at Hopewell Furnace NHS site French Creek for various sampling dates.

Common Name	Scientific Name	1990	1991	1992	2002
American eel	<i>Anguilla rostrata</i>	3	1	1	1
Rosyside dace	<i>Clinostomus funduloides</i>	3	19	22	
Cutlips minnow	<i>Exoglossum maxillingua</i>	7	4	4	10
Common shiner	<i>Luxilus cornutus</i>		4	8	
Blacknose dace	<i>Rhinichthys atratulus</i>	1	10	11	26
Creek chub	<i>Semotilus atromaculatus</i>		1	9	11
Fallfish	<i>Semotilus corporalis</i>	34	26	19	62
White sucker	<i>Catostomus commersoni</i>	3	4	2	12
Yellow bullhead	<i>Ameiurus natalis</i>	1			
Margined madtom	<i>Noturus insignis</i>	13	8	10	10
Redfin pickerel	<i>Esox a. americanus</i>	1			
Chain pickerel	<i>Esox niger</i>		1		3
Green sunfish	<i>Lepomis cyanellus</i>	4			
Pumpkinseed	<i>Lepomis gibbosus</i>	12	1	2	
Bluegill	<i>Lepomis macrochirus</i>	4	3	4	6
Largemouth bass	<i>Micropterus salmoides</i>	3		2	1
Tesselated darter	<i>Etheostoma olmstedii</i>	3	17	5	8
	Total	92	99	99	150

**Appendix D. Inorganic Water Quality Data Summary for
Hopewell Furnace NHS, Electrofishing Sample
8-21-02.**

Parameter	Location		
	Sprout Run	Baptism Creek	French Creek
pH	7.21	5.74	7.04
SPC (uS/cm)	99.2	44.1	87.4
NO3-N (mg/l)	0.251	<0.013	0.109
Turbidity (FTU)	10	2.56	3.33
SO4 (mg/l)	9.08	2.65	6.74
Cl (mg/l)	11.34	11.19	15.13
Pb (mg/l)	0.016	0.02	0.024
Ni (mg/l)	0.033	0.034	0.043
Cd (mg/l)	0.006	0.008	<0.005
Fe (mg/l)	0.072	0.042	0.031
Al (mg/l)	0.009	0.023	0.01
Ortho-P (mg/l)	<0.005	<0.005	<0.005